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**EX PARTE**

April 7, 1997

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APR 7 1997

Federal Communications Commission
Office of Secretary

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W. Room 222
Washington, D.C. 20554

RE: In the Matter of Federal-State Joint Board on Universal Service - CC Docket No. 96-45

Dear Mr. Caton,

The attached information was provided to State Staff Members of the Federal-State Joint Board on Universal Service in the above referenced proceeding. The attached information was developed by Sprint and U S WEST with INDETEC International.

The information consists of Attachment A which is the result of a preliminary review of the Hatfield Model, version 3.1. Attachment B is a commentary on the March 26, 1997, document entitled State Members' Report on the Use of Cost Proxy Models.

Sprint and U S WEST request that this information be made a part of the record in this matter. Two copies of this letter, in accordance with Section 1.1206(a)(1), is provided for this purpose. If there are any questions, please feel free to call.

Sincerely,

Warren D. Hannah

Warren D. Hannah

Attachments

c: The Honorable Reed Hundt
The Honorable Rachelle Chong
Mr. Robert Loube
Mr. David Krech
The Honorable Susan Ness
Ms. Jeanine Poltronieri
Ms. Emily Hofnar

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*Alan J. Sykes*
*Vice President*
*Revenues*

April 4, 1997

TO: The Honorable Julia Johnson
The Honorable Kenneth McClure
The Honorable Sharon L. Nelson
The Honorable Laska Schoenfelder
Martha S. Hogerty

Dear Universal Service Joint Board Members:

US West and Sprint wish to share with you the results of their analysis of the Hatfield version 3.1 cost proxy model and our comments on the March 26, 1997 State Members' Report on the Use of Cost Proxy Models.

The attached analysis provides detailed evidence of erroneous assumptions, logic errors, and omissions that completely invalidate the results of the Hatfield version 3.1 cost proxy model. These problems are so egregious and pervasive as to make the Hatfield model irreparable.

We believe that the State Members' Report sets out in a very understandable and concise way the issues concerning the current state of the proxy modeling effort, and what needs to be done to complete the development of a model which can be used for the Universal Service effort. We also clarify in our comments issues related to the BCPM and offer suggestions on other issues relative to the targeting of funds and the establishment of incentives for competitors to enter the local exchange market on a facilities basis.

If you have any questions on the attached material, we will be happy to answer them. We stand ready to provide any assistance you may require from us.

Sincerely,

Alan J. Sykes

LEM/ss

Attachment

cc: Charlie Bolle
Rowland Curry
Lori Kenyon
Sandra Makeeff
Lee Palagyi
Barry Payne
Paul Pederson
Brian Roberts

**ATTACHMENT A**

Preliminary Review
of the
Hatfield 3.1 Model

presented by US West and Sprint
with INDETEC International
April 7, 1997

## OVERVIEW

- The source of the ***CBG data*** has been changed and the results are often inexplicably different than in the most recent iteration of the model

- Although numerous ***inputs*** can be adjusted by the user, several of those that are changed by the user are ignored - - they are not utilized in the calculations that cost out the network. Also, numerous critical inputs are hard-coded.

- There are ***faulty assumptions*** in the algorithms.

- There are many, many ***logic errors***.

- There are numerous plant ***omissions*** from the network. The network that is costed out by the Hatfield 3.1 model will not work.

## CBG DATA

The 3.1 version of the model uses clustering data provided by PNR to locate the households and businesses. This new source of data seems to have created a series of inexplicable results. Many of the CBG centroids have changed their location in relationship to the central office. Where the direction to the central office was once east, for example, the direction is now west. The change in the directional orientation varies from just a few degrees in some cases to over 180 degrees in others.

It is understandable that a change in the source of locational data would create minor changes - - in either distance, orientation, or both. However, the changes are so dramatic and seemingly un-patterned as to raise doubts as to their veracity.

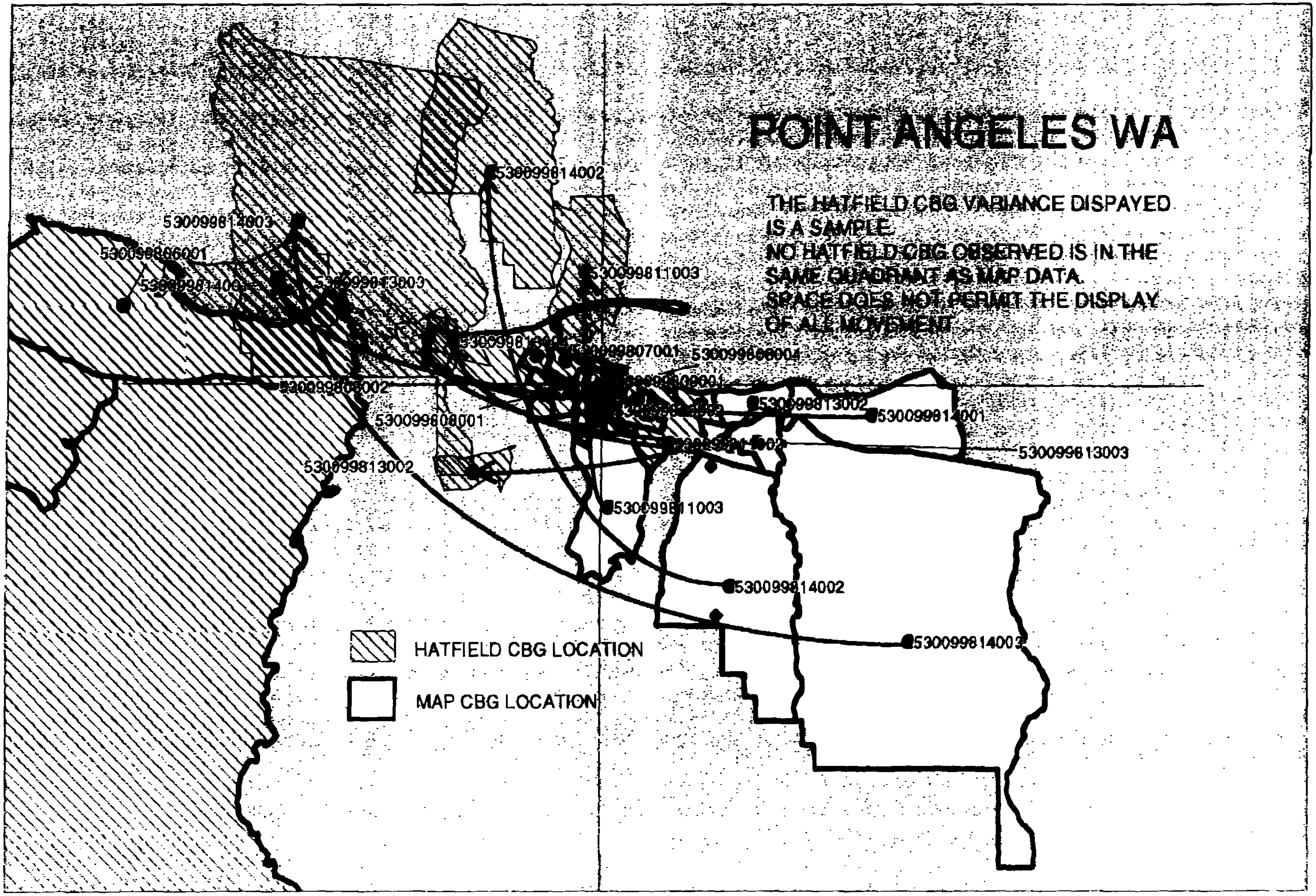
Distance from the office has also changed drastically - - but again only in some cases. The combination of orientation and distance changes has placed some centroids in the middle of water. In looking at just a few CBGs served by General Telephone in the state of Washington we have found numerous inexplicable changes. A map has been included to highlight the types of inexplicable changes that have occurred.

## USER INPUTS NOT ALWAYS USED

The documentation rightly states that many inputs can be modified by the user. It was disconcerting, however, to discover that not all of those inputs that are made by the user flow through to the actual calculation of the costs of the network. That is, the user can make a change to the default values in the user input interface, but that change is not used when it comes time to do the calculation.

Examples were found in the expense inputs, the feeder inputs, and the distribution inputs. Some user modifications in the structure fraction assignment in the expense area is not recognized. Any user modification to the regional labor multiplier is not recognized. Any change to the town lot size is not recognized.

An interesting treatment of town lot size warrants further discussion. When a change is made by the user to the *town* lot size, the model immediately modifies the *maximum* lot size to equal the value that was input for the town lot size. The *maximum* lot size is then used in the calculation and the change in the *town* lot size is ignored and the value reverts back to the default value of three acres.


POINT ANGELES WA
THE HATFIELD CBG VARIANCE DISPAYED
IS A SAMPLE.
NO HATFIELD CBG OBSERVED IS IN THE
SAME QUADRANT AS MAP DATA.
SPACE DOES NOT PERMIT THE DISPLAY
OF ALL MOVEMENT
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530099808001
530099813002
530099814001
530099813003
530099811003
530099814002
530099814003
HATFIELD CBG LOCATION
MAP CBG LOCATION

## CRITICAL INPUT DATA IS HARD CODED

The documentation rightly states that numerous input values can be modified by the end user. Unfortunately, the 3.1 model continues to hard code critical variables.

- Fiber is only installed if lines per quadrant exceed 24.
- The cable gauge multiplier is only permitted to affect 16% of the cable costs.
- The regional labor adjustment is only permitted to affect 12.5% of the buried and conduit placement costs.
- The high rise indicator fixes the area trigger (expressed in square miles) at .03 square miles and fixes density (expressed in lines per square mile) at >30,000 (column BE).
- The high -rise factor fixes occupied building space at 1500 square feet per household and 200 square feet per employee (column BF).
- The number of riser pairs required per cable is fixed at twice the number of households plus half the public, special, and business lines (column BG).
- The number of maximum riser cables divisor is fixed at two (column BH).

## FAULTY ASSUMPTIONS

Although the review team has only been able to scrutinize half of the distribution module, and has not yet analyzed the other modules, there are numerous concerns with the algorithms in that module. There are faulty assumptions, logic errors of various kinds, and numerous omissions of outside plant necessary for a working network.

One example of a faulty assumption is the capping of the average lot size at three acres. We find that assumption to be unreasonable. While it may be understandable in an attempt to reduce the cost of the network, the assumption makes a mockery of reality.

Taking a random sample of Sprint-served CBGs revealed the following:

- Missouri average lot size = 13.7 acres
- Kansas average lot size = 17.4 acres
- Nebraska average lot size = 29.5 acres

From the perspective of dollars, the impact of such an assumption is not insignificant. Looking just at the Sprint territories in Missouri, if the average lot size were allowed to increase by one acre (up to four acres), the same Hatfield 3.1 model calculations would produce an additional $7.8 million. Allowing the average lot size to increase by four acres (up to seven acres) would yield an additional $18.9 million over the original calculation.

The impact of this assumption, coupled with the Hatfield 3.1 clustering mechanism produce misleading results. The Hatfield Model 3.1 uses the term "clustering' to describe its approach to building the network in less dense areas (CBGs with density < 200 lines per square mile.) Customer locations (both business and residential) are grouped together to produce a smaller geographic area served by the LEC. However, two serious problems exist with the method used by the model:

- *There is no evidence that engineering or geographically-based criteria are used as a basis for this grouping.*
- *Clusters of locations that actually exist are ignored by the grouping algorithm.*

As a result, the model produces serious distortions of customer location and the cost of serving them.

To illustrate this problem, the diagram below contains 4 stylized CBGs: A, B, C and D. Each oval represents 10 households for a total of 100 households per CBG.

Each stylized CBG has the same land area, same number of census blocks (8, defined by the dotted line), same amount of unpopulated area (25%). However, in certain CBGs the customers are clearly situated in groupings or "clusters". The

CBG labeled "A" shows 5 clusters. "C" shows 2 clusters. "D" shows 4 clusters and "B" does not show any obvious clusters.

- *The grouping algorithm in the Hatfield Model 3.1 would ignore the existing clusters, and build the same number of clusters, four (4), in every CBG. Eighty-five percent of customers would be placed within these 4 clusters (85% is the Hatfield default value).*

  The only criteria for determining the number of clusters used in the Hatfield model is the amount of unpopulated area, which is the same in CBGs A, B, C and D.

- *More importantly, the **size** of the four clusters would be exactly the same for each of the four CBGs, ignoring the actual amount of area in which customers are located.*

  Each household in a cluster is given a lot size of 3 acres, the lots are assumed adjacent, and this forms the area of the cluster.

- *In addition, the **number of customers** in each cluster would be exactly the same for each of the four CBGs.*

  Each Hatfield cluster is constructed to contain 1/4$^{th}$ of 85% of customers. In doing this, existing clusters (such as those found in CBG "C") are ignored by the model.

- ***Example of Size Distortion:** A CBG located in Chilhowee, Missouri has an overall area of 78.5 square miles, and a populated area of 76.9 square miles. The Hatfield 3.1 model places 85% of residents within an area of two (2) square miles.*

  As a result of this grouping process, the amount of distribution cable needed to serve customers is grossly distorted, as is the amount of investment required. Shown below as an example are two CBGs taken from Sprint territory in Missouri.

**The two are significantly different in terms of size, population and density. Yet as a result of the Hatfield 3.1 "clustering" process, the model produces nearly identical results for the two.**

One CBG is located in **Deepwater, Missouri** (south of Clinton, Missouri). The other is in **Newberg** (right outside Rolla, Missouri).

The Deepwater CBG ( 290839504005) serves approximately **330** customers in a populated area of **60 square miles**.
The Newberg CBG (291619905003) serves approximately **490** customers in a populated area of **35 square miles**.

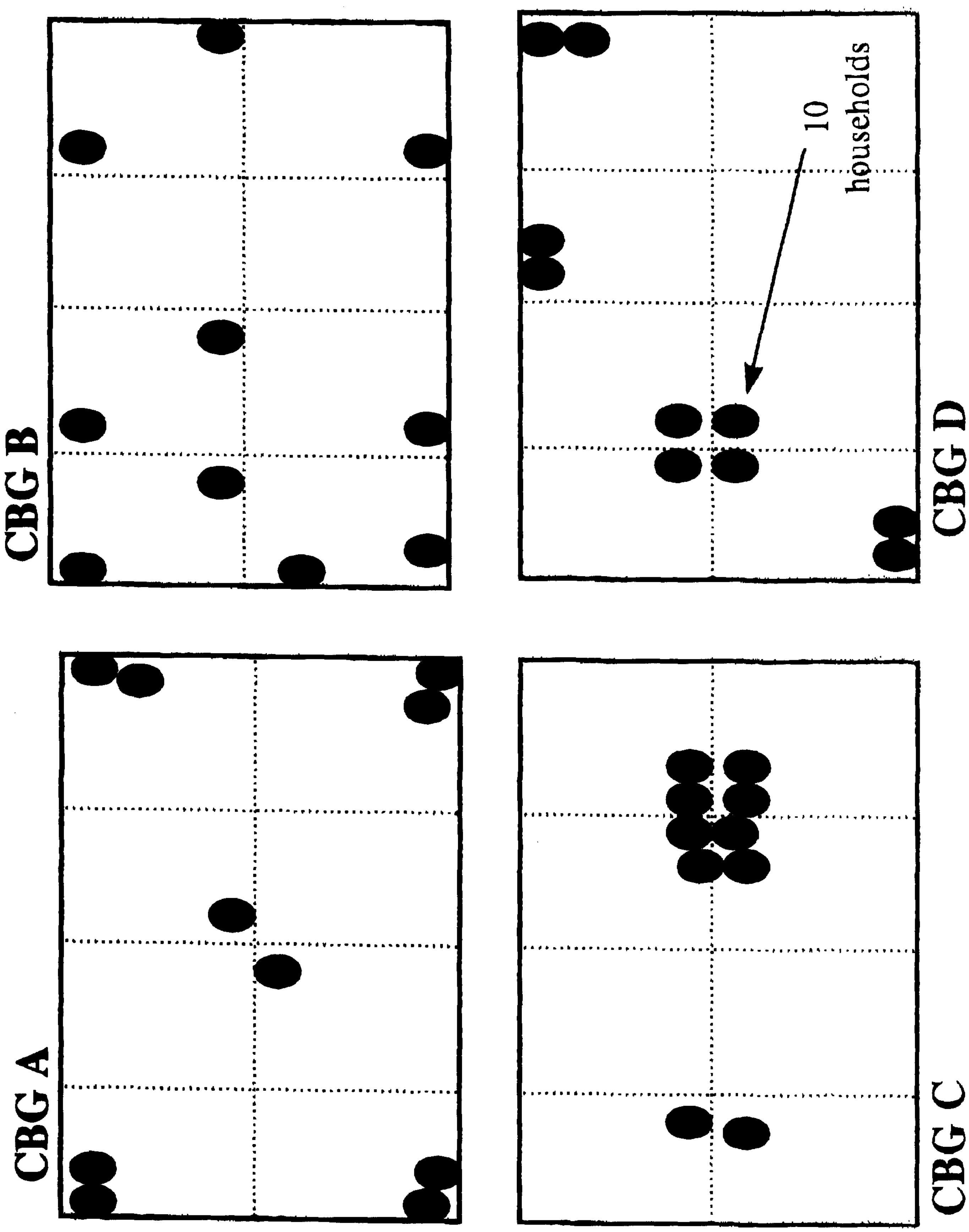
Hatfield 3.1 Model Results (Distribution Module)

| | Total Distribution Distance | Buried Distribution Cable $ | Aerial Distribution Cable $ |
|---|---|---|---|
| Deepwater | 312,269 | $365,529 | $117,157 |
| Newberg | 311,907 | $359,766 | $115,310 |

**As the table shows, the Hatfield 3.1 model produces equal amounts of distribution and investment, despite the fact that the CBGs differ in area by nearly 25 square miles.**

This overall distortion is exacerbated by the fact that all CBGs with a density under 200 lines per square mile are "clustered" (assuming the area of the cluster is smaller than the populated area.) There are 39,739 CBGs that fall into this density category, approximately 18% of all CBGs.

The BCPM, in contrast, takes into account existing customer location (both orientation and distance) when calculating area in less dense regions by using the underlying road network.


CBG B
CBG A
CBG D
CBG C
10 households

## LOGIC ERRORS

In building the lot sizes, the Hatfield model assumes that every lot is twice as deep as it is wide. Without comment on the accuracy of that assumption, let it be said that the calculation to reflect that assumption is flawed. The calculation methodology is to take the square root of the side, and multiply that by ½ to determine the lot frontage. They then multiply the original side by 2 to calculate the depth. Unfortunately that yields a depth to frontage ratio of 4:1, not 2:1.

The proper multiplier for the frontage should be .7070, not ½.

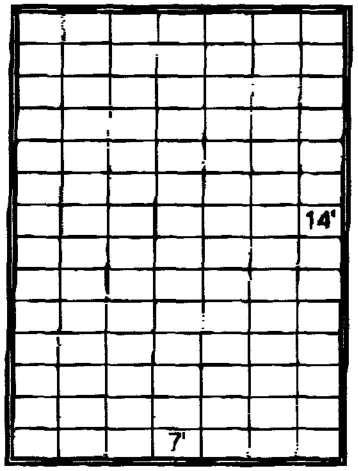
Placing illustrative numbers into the description may help describe the errant situation. If the lot were 40,000 square feet, the Hatfield model would take the square root of that to determine its side as 200 feet. It would then (incorrectly) multiply that by .5 to calculate the frontage (incorrectly) at 100 feet. It would then go back to the original side of 200 feet and multiply that by 2 to come up with a side of 400 feet. That results in a side of 400 feet and a front of 100 feet - - a 4:1 ratio of depth to frontage - - with resultant construction changes as well.

The impact of this logic error is rather widespread as the output of the calculation ripples throughout other portions of the distribution module. It has an effect on the following:

- backbone cable length
- branch cable length
- number of branch cables
- vertical connecting cable
- need for remote terminals
- pairs required per branch

The following diagram highlight visually the impact of this logic error.

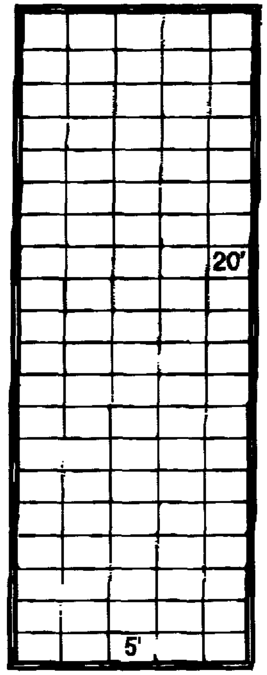
# HATFIELD 3.1
# LOT SIZING FOR 100 SQUARE FOOT LOT




What Hatfield 3.1 says it does.

.5 * Square Root of 100
= 5 on Front

That means
20' deep.




What Hatfield 3.1 actually does.

Correct formula should be: .707 * Square Root of Area

This miscalculation flows through to distribution area and investment results.

## MORE LOGIC ERRORS

The calculation for difficult terrain also has a significant problem. Interestingly enough the default value for difficult terrain is one. That is, in the Hatfield model, where the increased cost for placing plant in difficult terrain is recognized by a multiplier of the length, the default value is one. Therefore, unless the user changes the default value, no recognition of difficult terrain would be made at all.

That issue notwithstanding, if the user does indeed change the multiplier, it should then be multiplied by the distance of the terrain that has the difficult soil. However, in the 3.1 version of the Hatfield model, the multiplier is applied to the simple terrain, not the difficult terrain. That is if a five mile route had two miles of rocky soil, the difficult terrain multiplier put in by the user would be incorrectly multiplied by *three* miles (the easy terrain) instead of the two mile section of difficult terrain. (This can be seen in the calculation worksheet, column L.)

**LOGIC ERRORS (continued)**

The calculation for digital terminals is incorrect. In the calculation worksheet, columns AZ, one can see that the quantity of terminals for high density areas (column AY) is incorrectly used in low density area investment. A low density quantity (column AX) is calculated, but is not used in the investment calculation.

This error would have the effect of understating the cost of the network. For the Sprint territory in Missouri alone, this represents a movement from $1.5 million to $2.1 million, a 36% difference.

## OMISSIONS

During the investigation of the distribution module, it became evident that several critical portions of the network have been left out. This has two obvious results: the cost of the network required by law is understated and the network won't work.

***Pole investment*** is missing in dense areas. Looking at the calculation worksheet, column AM, one can see that if the density in an area is greater than 5000 households per square mile, no pole investment is included. This is puzzling since the distribution plant is purported to be 65% aerial for areas of density greater than 5000 households per square mile, and 85% aerial for areas of density greater than 10,000 households per square mile.

For Bell Atlantic territory in Delaware , for example, to properly include the poles increases the investment from 18.0 million to $20.5 million (a 14% increase).

***Manhole investment*** is totally missing. A review of the calculation worksheet, column AO reveals that absolutely no investment for manholes is included.

All of the ***horizontal connecting cables*** are left out as well, except where low density remote terminals are used. Column AI on the calculation worksheet shows that omission.

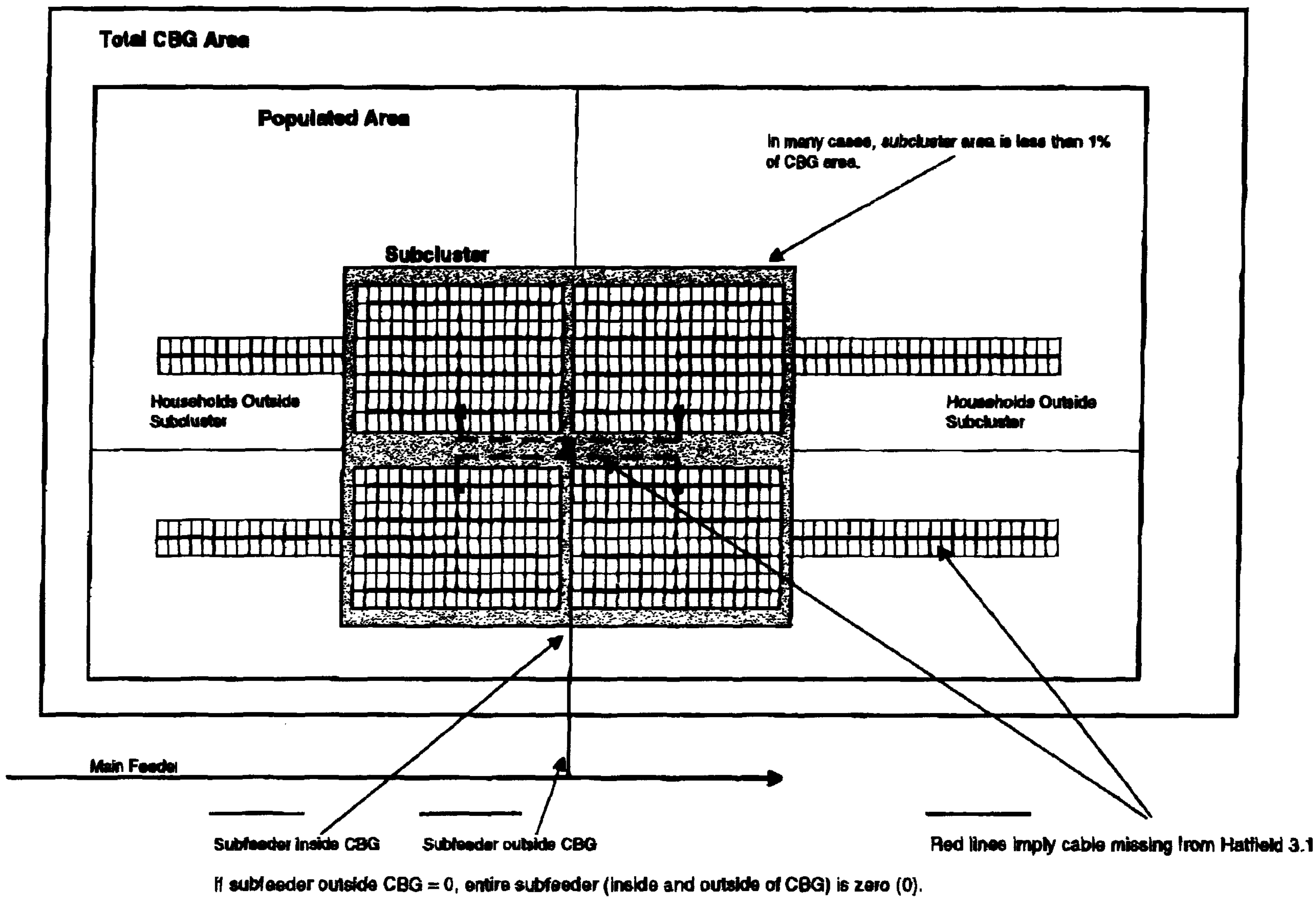
The ***riser cable investment*** is calculated, but not included (see feeder module).

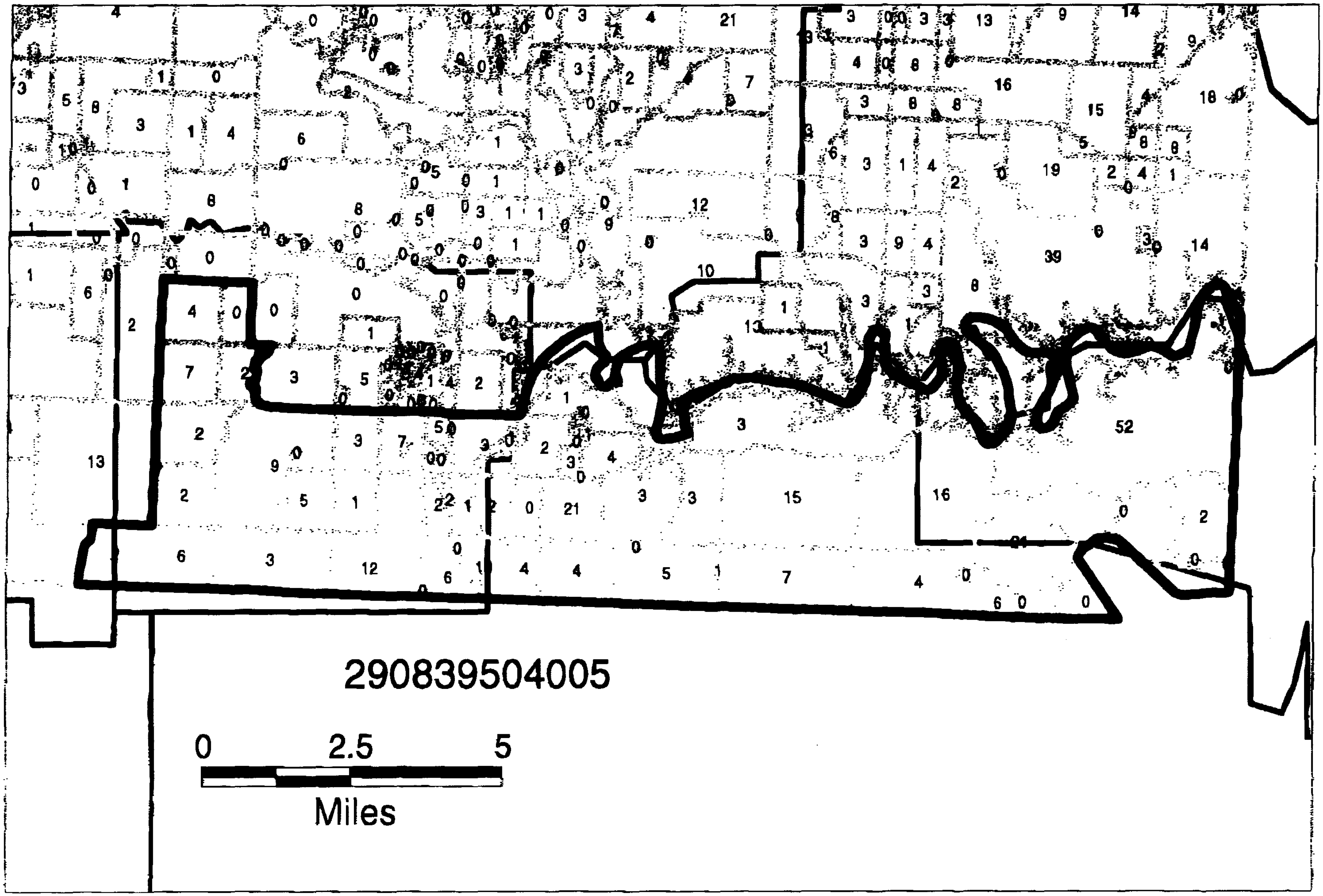
The ***maximum size road cable investment*** is only computed for two feet of cable. The distance component of the equation is missing in the calculation (see column AH).

If the main feeder extends to the boundary of the CBG, the ***subfeeder*** needed inside the CBG is incorrectly omitted. See the output worksheet, column G.

The ***main road cable distance***, as calculated, will only reach ¼ of households outside the town area. Column AE will reach only ½ the households and businesses that are outside the "town" area in a cluster. Since column AH subsequently uses 2 x the value in column AE for the total CBG, all cable, poles, conduit, and placement costs for the "out of town" area are understated by a factor of 1/quantity of clusters. [see diagram]

Clearly, the resultant network will not work. With so many problems discovered in a review of one-half of one module, there has to be concern about the continued viability of the model.


Total CBG Area
Populated Area
In many cases, subcluster area is less than 1% of CBG area.
Subcluster
Households Outside Subcluster
Households Outside Subcluster
Main Feeder
Subfeeder inside CBG
Subfeeder outside CBG
Red lines imply cable missing from Hatfield 3.1
If subfeeder outside CBG = 0, entire subfeeder (inside and outside of CBG) is zero (0).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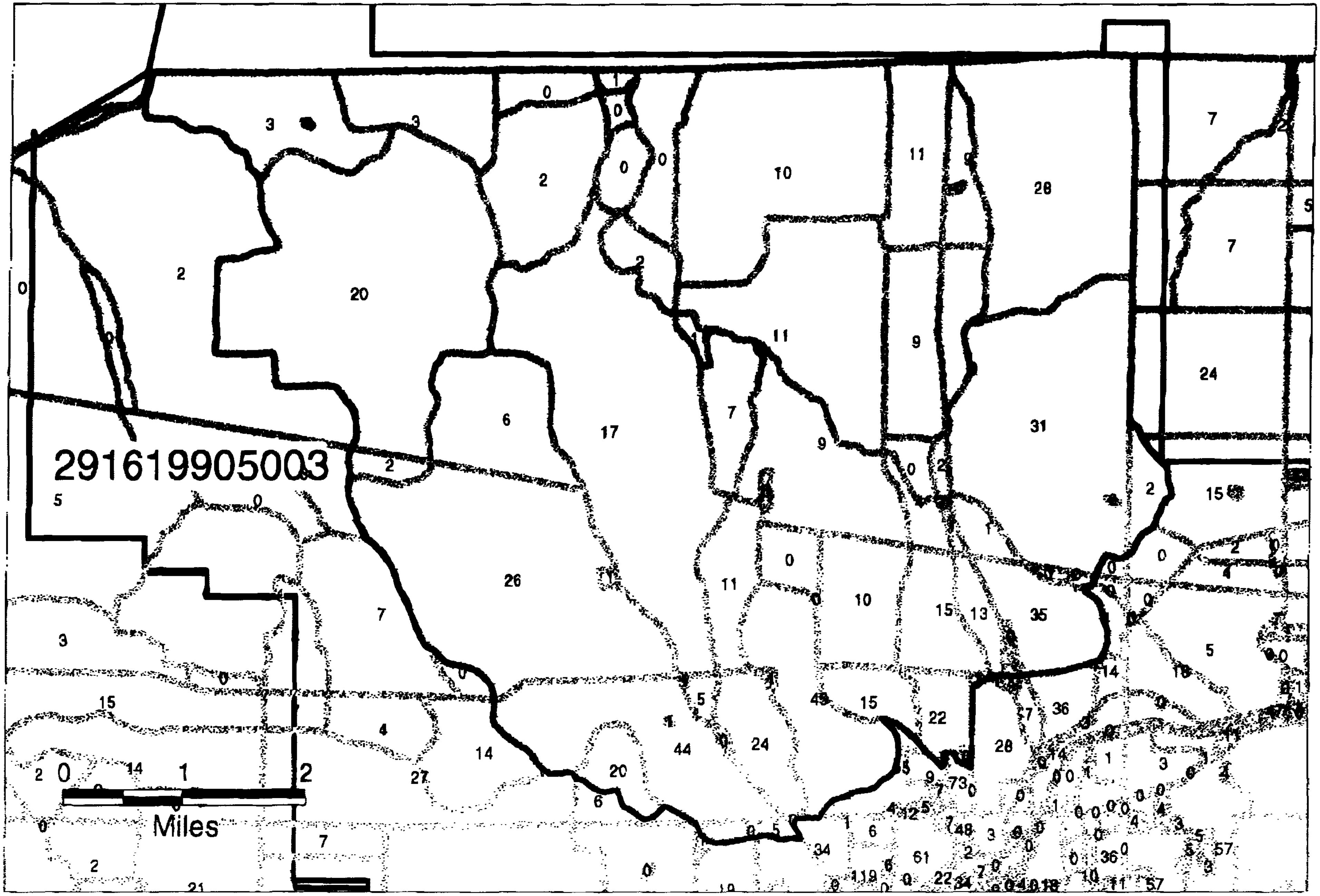

**ATTACHMENT B**

On March 26, 1997 the State Members of the Universal Service Joint Board filed a document entitled State Members' Report on the Use of Cost Proxy Models (the Report) As sponsors of one of the proxy models evaluated in the report, the Benchmark Cost Proxy Model (BCPM),. Sprint and US WEST commend the State Members for the thoughtful and well documented report which they have submitted. We do, however, have several thoughts which we believe will help clarify issues raised in the report, and help the FCC to reach a decision on proxy models and targeted explicit high cost support which will serve the public interest and fulfill the mandate of the 1996 Act.

## Geographic Area for Targeting

Both US West and Sprint have advocated targeting support to the census block group (CBG) level, while the Report recommends support be targeted to the wire center.

We recommend that support be targeted to the CBG for one simple fact - - in virtually every high cost wire center while there are high cost customers in remote areas, there are a significant number of low cost customers in close proximity to the central office. Indeed, as the data on the record in this proceeding clearly indicates, there is significantly more implicit support *within a wire center* (i.e. low cost "Main Street" customers subsidizing high cost rural customers) than *between any two services* offered by LECs. Our primary concern, as stated repeatedly in our advocacy, is that if an explicit subsidy is based upon wire center average costs, there will be an incentive for new entrants to focus their marketing efforts to those lower cost customers. That will enable them to reap a potential windfall of support. This could occur even if, as a precondition for receiving support, carriers are required to offer service to all customers within a wire center. This is true for several reasons:

- there are generally more lower-cost customers than higher-cost customers within the wire center (i.e. it costs less to serve where more people live,).
- even if carriers have to *offer* service to all in an exchange they do have a choice *how* and *to whom* they market their services
- at least initially, new entrants will most likely be serving high cost customers through resale of the incumbent's local service or loop.
- the ratio of low-cost and high-cost customers will never be equal between service providers

Thus it is important to minimize that potential arbitrage.

Although we feel that the CBG-based distribution is theoretically the most pure method, we understand that may not be possible in the first year of operation. As was suggested by the state members of the Joint Board, it may be necessary to use an exchange-level method for a period of time. However, in an attempt to minimize the deleterious effects of arbitrage, we would suggest that an exchange be split into three "zones" where only the high cost "zones" of an exchange would receive support. We are currently working on a methodology that utilizes a combination of density and distance to identify high cost zones within an exchange. This would allow the more accurate method of CBG-based distribution to be perfected during the year of 1998.

**Structural Problems**

There seems to be confusion about what is a model structural problem and what are, in reality, data input problems. After reviewing the Joint Board's analysis of the BCPM, it became clear that the issues that the Joint Board addresses are all data input related.

On page 8 (E) of their report, the Joint Board has commented on a problem with identifying the correct line counts at the wire center level. They have correctly identified problems in assigning CBGs to associated serving wire centers. In addition to the problem of CBG assignment there is the problem of getting an accurate line count data at the wire center level in order to true-up the number of lines identified by CBG, to a wire center level. The BCPM sponsors believe that the use of census block data, and the possibility of identifying clusters of census blocks, which can be assigned to the correct wire center, will greatly improve the accuracy of lines assigned to the proper serving wire center. If line count data were available from the incumbent local exchange carriers at the wire center level the error rate could be eliminated, or at least reduced to an acceptable level. The sponsors are working on methods to address the CBG problems and would welcome an initiative by the Joint Board to issue a data request which would include a count of lines by wire center. In any case, this issue is one of using the available data to the best extent possible and of data availability, not a model structure problem.

In addition to helping to solve the line count problem, the use of census blocks and the assignment of the centroid of the census block to a wire center will provide for more efficient network development. This will alleviate the problem of using digital loop carrier to serve areas of a CBG which are close enough to the wire center to serve with copper cable.

**Cost of Capital**

On page 13 of their Report, the Joint board discusses the "framework of risks associated with competitive entry and the cost of money". The Joint Board argues that the efficient provision of universal service occurs at the wire center level, and that a competitive entrant that enters the market on less than a wire center level could be expected to fail because their costs would higher than their competitors. The BCPM Joint Sponsors disagree with this contention on two specific points:

1. Many competitive entrants will enter the market through the use of leased or resold facilities, or a combination of owned facilities and various combinations of lease and resale. The business cases of these entrants will target high volume customers within a geographical area which may cover parts of several wire centers, and possibly not all of any wire center.

2. Keeping the cost of capital low or "just sufficient to cover the opportunity cost of money to investors in the wire center" will certainly guarantee that no competitor will be a facilities based carrier.

**Fiber/Copper Cross Over**

On page 17 of the Joint Board Report, it is stated that: "The third condition under which the BCPM model places fiber rather than copper is when the number of pairs needed for a feeder exceeds the maximum copper cable capacity. This variable is set at 4,200 copper pairs, above which the facility must use fiber and DLC technology."

This assertion is not totally accurate. The BCPM actually converts feeder pair requirements to fiber for a specific CBG if that CBG requires more pairs than the maximum cable size for the subfeeder inside the CBG. It then adds the copper or fiber requirements for that CBG to all CBG requirements for CBGs beyond it to determine the main feeder sizes and types. BCPM does not convert the entire main feeder as the Report implies. If you think of a tree with trunks and branches, BCPM changes the branch inside the CBG to fiber. The main trunk still carries the number of cables of each type that are required (fiber, copper, or both) to serve all the CBGs (branches) it feeds.

Main feeder cables will overflow to multiple cables if the number of copper pairs or fibers exceed the maximum cable sizes. For example, assume that there are a number of CBGs along a feeder route, all loops of which are short enough to be served by copper. The first CBG serves 4,500 loops. The balance of the CBGs farther out serve 12,000 loops. The first CBG exceeds maximum copper size so it will be served with a 12 pair fiber cable. The feeder for the balance of the CBGs will be all copper and requires 2 - 4,200 pair cables and 1 - 3,600 pair cable. The 3 copper feeder cables and the one 12 fiber cable share the main feeder facilities out to where the first CBG branches. The multiple copper cables continue on and taper as necessary to feed the other branches.

**Source Data for Default Factor Calculations**

As part of the BCPM development process, the model sponsors solicited estimates of forward-looking investment, capital and expense factors from other large LECs. This data became the basis for many of the default factors in the BCPM. Not all of the large LECs chose to participate, and unfortunately, several of the companies who did choose to supply this data feel that the underlying source data is proprietary. Thus we were unable to place the full support for these default factors on the record in this proceeding.

Rather than focusing on refining inputs, the BCPM sponsors spent the majority of our effort on assuring that the model was right, and that it accurately designed and analyzed